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ABSTRACT

The manual is designed to help educators effectively integrate language and content instruction in teaching students who are learning through a language other than their native tongue. The manual is targeted at teachers, administrators, and teacher trainers involved in English-as-a-Second-Language or bilingual instruction and content-area instruction for limited-English-proficient students. The manual presents a whole educational approach to be used in elementary and secondary classrooms by both content-area and language teachers, and emphasizes collaboration between those two disciplines. In this approach, curriculum integration takes two general forms: (1) content material is incorporated into language classes, and (2) accommodation is made for students' limited English proficiency in content classes. The guide provides information on the approach and its rationale, on specific strategies for integrating language and content instruction, and on specific techniques for adapting materials and for developing lesson plans. The guide also discusses key issues in implementation and outlines three major models for implementation: sheltered classes, integrated curricula, and the whole-school approach. A final section presents the agendas for four staff development workshops of varying lengths and focuses. Appended materials include subject-specific instructional strategy outlines, sample material adaptations and lesson plans, a list of further reading, and a glossary. (MSE)

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HOW TO INTEGRATE LANGUAGE AND CONTENT INSTRUCTION: A TRAINING MANUAL

Deborah J. Short
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Center for Applied Linguistics

ER15

CLEAR

CENTER FOR LANGUAGE EDUCATION AND RESEARCH

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University of California, Los Angeles

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Center for Language Education and Research
University of California
1989

Center for Language Education and Research

The Center for Language Education and Research (CLEAR) is funded by the Office of Educational Research and Improvement (OERI) to carry out a set of research and professional development activities relevant to the education of limited English proficient students and foreign language students. Located at the University of California, Los Angeles, CLEAR also has branches at the Center for Applied Linguistics in Washington, D.C., Yale University, Harvard University, and the University of California, Santa Barbara.

CLEAR believes that working toward a language-competent society should be among our nation's highest educational priorities. Thus, CLEAR is committed to assisting both non-native and native speakers of English to develop a high degree of academic proficiency in understanding, speaking, reading, and writing in English and a second or native language. To work toward this goal, CLEAR has united researchers from education, linguistics, psychology, anthropology, and sociology with practitioners, parents, and community agencies.

A coordinated set of research, instructional improvement, community involvement, and dissemination activities are oriented around three major themes: (a) improving the English proficiency and academic content knowledge of language minority students; (b) strengthening second language capacities through improved teaching and learning of foreign languages; and (c) improving research and practice in educational programs that jointly meet the needs of language minority and majority students.

The CLEAR Educational Report Series is designed for practitioners and laypersons interested in issues in second language education and foreign language teaching and research.

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PREFACE

Many students are faced with the challenge of learning through a language other than their mother tongue. They need to develop the required language skills for participating in all aspects of schooling, while they strive to keep pace with native-speaking classmates in content mastery as well. Many educators have found that combining language and content instruction can be an effective way of helping these students work toward both goals.

This manual is addressed to teachers, administrators and teacher trainers who are helping students learn through a language which is not their mother tongue to enable them to effectively integrate language and content instruction. The educators may be ESL (English as a Second Language) or EFL (English as a Foreign Language) teachers, bilingual teachers, or content/subject matter (e.g., science, math, social studies) teachers who have limited English proficient (LEP) students. Language and content integration can be incorporated into a variety of instructional programs: ESL/EFL classes, bilingual education, sheltered English, and mainstream content classes. Although this manual does not specifically address foreign language immersion classes, the approach could be used in these classes as well.

What Is the Objective of this Manual?

This manual presents a whole education approach to integrating language and content instruction in elementary and secondary classrooms. The approach can be used by both language and content teachers. Its underlying assumption is that a child's whole education, language and academic content growth is a shared responsibility.

The integration is twofold:

1) Content material is incorporated into language classes.
This material includes specific terminology, types of reading passages, required writing styles (e.g., science lab reports), and cognitive thinking skills. This type of instruction, referred to as content-based language instruction, prepares the students for the academic demands that subject area classes impose.

2) Accommodation is made for the students' limited English proficiency in content classes.
This occurs through the adaptation of language and materials and the presentation of information that is more comprehensible to these students. This type of instruction, which can be referred to as language-sensitive content instruction, assists these students in their pursuit of academic success.

Crucial to the effective implementation of this program is the close cooperation of the language and content teachers, since input from both areas is needed.

This integrative approach is recommended for both language and content classrooms to bridge the gap that has often separated these two disciplines. With this approach, LEP students begin academic studies earlier, while receiving linguistic support and training in academic cognitive skills. They thereby increase their chances of understanding the subject matter and of succeeding in their education.

Educators recognize a need for a more integrated approach in order to address concerns that have repeatedly arisen in instruction of LEP students. A number of factors contribute to the motivation and achievement problems experienced by these students:

1) Teachers have concentrated on language development and have thus delayed academic cognitive skill and content instruction until a certain proficiency level in English has been reached.

2) In ESL classes, LEP students have felt isolated from the standard curriculum that other students in their grade level follow.
3) By not having the opportunity to demonstrate talents they may have in certain subject areas, many gifted students have gone unrecognized.
4) Once LEP students have been placed in regular content courses, they have often fallen behind the other students, because they have not developed the cognitive skills needed to adequately process the material.

The combination of these factors has led to a high failure rate among LEP students and has precluded them from reaching their intellectual potential.

One reason that instruction in language and content has been kept distinct is that many teachers do not feel prepared to integrate the two domains. Language teachers have expressed reservations about teaching content subject matter which may be outside their realm of expertise. Content teachers, similarly, may not understand language issues, nor be ready to use ESL techniques for which they have had little or no training, especially if they have a heterogeneous class of language majority and language minority students.

Certain administrative practices have also discouraged widespread use of this integrated approach. Frequently, there is insufficient planning time scheduled to let content and language teachers cooperate in preparing their integrated instruction. Curriculum guidelines with specific deadlines for meeting particular objectives may place heavy demands on the teachers, too.

Who Can Benefit from this Manual?

Teachers

Elementary ESL teachers in pullout situations may want to complement and reinforce the regular classroom teachers' instruction. With this approach, these ESL teachers can contribute to LEP students' sense of accomplishment when they learn English and receive extra "tutoring" in the subjects they encounter in other classrooms.

Secondary ESL teachers may want to supplement a standard ESL curriculum which might be grammar- or function-based. By adding content themes, they can enhance the students' interest and better prepare them to enter the mainstream courses at a level appropriate to their highest potential, not simply at the lowest level available because of their limited English proficiency. Some teachers who already teach a combined ESL and content course (i.e., sheltered English) may use this manual to make their instruction more effective.

Bilingual teachers may want to further the use of content in the English section of their programs. These teachers can provide academic language training in English and help the students transfer their cognitive development from their native language to English. Moreover, this approach satisfies two-way bilingual program objectives, since instruction in the content component of the course is offered in both the students' native language and their second language.

Regular classroom, or content, teachers may use this approach to facilitate the success of their students with limited English proficiency by becoming more sensitive to the language used in their materials and in classroom discourse. While maintaining their focus on the instruction of content, they can learn to improve overall instruction by adjusting teacher talk, incorporating new activities, and adapting and developing materials for LEP students.

All teachers can use this manual to review the rationale behind the integrated content and language approach. Because the manual is a teacher resource, they can begin using the approach by trying the techniques, lesson plans, and steps for material adaptations presented here. With colleagues, teachers may also implement the suggested ideas for cooperation among language and content teachers.

Administrators and Principals. School administrators, and other educators who are responsible for the development and supervision of instructional programs, can utilize the ideas furnished in the implementation section of this manual to set up their own integrated program for language minority students or to help interested teachers in doing so. They can also review the success of the approach in other settings. In addition, they can get information about providing time and space for the cooperative work of language and content teachers and find recommendations for pre-service and in-service training programs.

Teacher Trainers. Teacher trainers can adapt models for staff development sessions and training workshop agendas. If desired, they can incorporate into their presentations some of the sample strategy sheets which are provided in the appendix. The manual also offers them a resource that concisely relates the basic theory underlying the approach to actual classroom implementation of integrated language and content instruction.

SECTION I

AN INTEGRATED LANGUAGE AND CONTENT APPROACH

The Approach

When teachers plan for the content and language growth of their students, they also need to plan for cognitive development. They must give careful consideration to the dimensions of these three types of academic growth in a well-planned, systematic manner. The content should be presented judiciously, not with watered-down versions of the information, but with thoughtful isolation and reinforcement of the salient features of that information. Nonetheless, this presentation must be made in a language that is understandable to the language minority student.

Our approach focuses on three principles which apply to both the content and language teacher:

1) the use of multiple media by teachers,
2) the fostering of thinking skills in students, and
3) the organization of the classroom.

All teachers should impart information through a variety of resources that extend beyond the standard modes of lectures and reading assignments. For example, they can use realia, graphs, demonstrations, and pre-reading and pre-writing strategies in order to place the information in a context comprehensible to LEP students. Teachers need to pay attention to the content to be learned, the language skills required to learn it, and the reasoning abilities needed to manipulate it, such as analyzing, synthesizing and evaluating. Additionally, teachers need to reorient their classroom into a more student-centered setting. They should accept the role of facilitator and increase student-to-student interaction.

Through this approach, content teachers become sensitive to language problems that exist in their current textbooks and supplementary materials, and recognize other potential problems their LEP students may exhibit. Language teachers are helped, as well, with training in methods to introduce authentic and relevant content into the classroom. The approach assists all teachers in determining which concepts of a topic to focus on and how to sort and present those concepts for maximum comprehension.

In this framework, each lesson has a language and a content component. These components are not necessarily given equal weight or time in each lesson, but are adjusted according to the teacher's daily objectives. The goal for each teacher should be to develop academic achievement and language proficiency simultaneously.

Rationale

Students can improve language proficiency through content instruction as either the background or theme of lessons. Focusing on content, which is provided in context, can help decrease students' anxiety in language classes because they are less concerned about using the proper linguistic forms (which may make them reticent to participate in class) than about studying, discussing and interacting with the content. Moreover, in a content course, processing the subject material can be made easier by a teacher who nurtures the LEP students' linguistic development and encourages their active involvement. Research has suggested that increased student participation and peer interaction enhances the students' language acquisition better than teacher-directed activities (Doughty and Pica, 1986). Since English is the medium for content instruction, the students are continually exposed to the language and have many more opportunities to practice its use.

Much current research on language acquisition discusses comprehensible input and communicative competence. The integrated approach presented in this manual incorporates both. Its major features can be summarized as follows:

1) Cognitive and language skills are both developed within the approach. Cummins (1979) suggests that many LEP students have acquired BICS (Basic Interpersonal Communication Skills) by the time they exit ESL classes. That is, they have the language skills needed for face-to-face social communication. However, few have developed CALP (Cognitive/Academic Language Proficiency), which refers to language skills necessary for success in academic or cognitive domains.

2) Language is effectively learned when it is the vehicle of instruction, not the object. Studies of immersion programs demonstrate that students reach high levels of second language development while mastering subject matter (Lambert & Tucker, 1972; Campbell, Gray, Rhodes & Snow, 1985).

3) Input is made comprehensible (Krashen, 1981; Krashen & Terrell, 1983) through a variety of means, such as the use of demonstrations, visual aids, hands-on materials and manipulation of the content, that the teachers include in their lessons.

4) Schema or background knowledge is built before a topic is introduced. Students need to be able to process material from the top down, having general knowledge of the broad picture before studying the details, as well as from the bottom up, being able to understand the vocabulary, syntax, and rhetorical style (Carrell, 1983). This observation applies equally to reading comprehension skills and writing activities, where an important pre-writing process is brainstorming.

5) Input furnished by teachers needs to build upon the students' present knowledge. New material is introduced systematically in conjunction with the students' background information. For example, once a general topic has been discussed and students have shared their knowledge of it, pertinent vocabulary may be taught. Later, certain concepts such as grammar rules or writing processes can be examined through the vocabulary.

6) Competence in communicative skills is demonstrated through student interaction with the material, fellow classmates and teachers. In negotiating this interaction, students must sometimes rephrase their thoughts and correct their errors so that others can understand their meaning. Research encourages this negotiation because it has been shown that as the teacher steps back from the role of lecturer and into the role of moderator, student language acquisition is enhanced (Long, 1983; Long & Porter, 1985).

7) Pair and group interaction patterns and activities are promoted in this approach, following Kagan's (1986) concept of cooperative learning. In this way, the students work together to learn the concepts and topics presented in the lessons. In a heterogeneous classroom with language minority and majority students, this cooperation can be particularly effective (Jacob & Mattson, 1987).

8) Learning strategies (Chamot & O'Malley, 1986; Oxford-Carpenter, 1985), such as organizing and summarizing information and asking questions for clarification, are included. These strategies assist the students in meeting the demands of their academic classes.

9) Students are challenged intellectually. In traditional programs, ESL students may be placed in low-ability groups, where it is difficult for them to learn how to respond to the higher level classes with more complex demands (see Richards, 1987).

SECTION II

STRATEGIES FOR INTEGRATING LANGUAGE AND CONTENT INSTRUCTION

This section suggests strategies for language and content teachers who use the integrated approach in their classes. Many of these are things that good teachers do naturally; however, it is worth enumerating them here so that their relationship to integrated instruction is clear.

Many of these techniques are used in the instructional **strategy sheets** which are included in Appendix A. They offer sample lesson plans that combine language and content, and explain the purpose, language and educational level of the strategy, the necessary materials, the basic procedure, and extensions for enrichment or other uses.

Pre-lesson Planning:

The following activities are recommended before a lesson is planned, preferably while curricula and syllabi are written. Close cooperation between content and language teachers is advisable.

* **Visit classrooms to observe the kinds of language, methods and materials used.** The language teacher can see what instructional methods and materials the content teacher employs, while the content teacher can see which strategies the language teacher uses with LEP students. The language teacher can also become familiar with the subject area textbooks.

* **Collaborate with colleagues** to identify the language and/or academic difficulties and demands that particular subjects or courses may present for LEP students. Some examples of those demands may be reading textbooks, completing worksheets, writing reports, doing library research, solving mathematical and scientific word problems, and using rhetorical styles in essays such as cause and effect, compare and contrast, argue and persuade.

* **Examine the material** that will be covered in the course. The teachers can try to identify specific problems LEP students may have with the material. Such problems do not result solely from the complexity of the passages, but from factors like the skills needed to complete accompanying exercises which may, for example, require some sequencing or summarizing of the material. Feedback from colleagues during the examination of materials can be very helpful.

* **Identify objectives of the course.** When developing the curriculum and syllabus for a course, keep in mind the specific objectives and adjust the material accordingly in order to eliminate extraneous detail which may only confuse a LEP student.

* **Identify key terms and words.** These can be pulled out and introduced in advance. It is also advisable to reinforce the new vocabulary throughout the lesson. Of particular interest are words which can clue students into what is expected of them, such as the terms altogether, more and less in math word problems and contrast in expository writing.

* **Look for appropriate materials.** The language teacher can choose content passages which illustrate the language structures or functions being taught. The content teacher can look for alternate versions of general textbooks which present the subject matter more clearly for LEP students.

* **Simplify and/or adapt written materials** to make them more understandable to the LEP students. This strategy is discussed in further detail in the following section.

Remembering Basic Principles:

Students are still learning English and the style of American education, so teachers should present information as clearly and systematically as possible.

* **Write legibly,** especially for students who have low levels of literacy or are accustomed to a non-Roman alphabet.

* **Develop and maintain routines** (e.g., types of assignments, ways of giving instructions) so that LEP students can anticipate what will happen without relying totally on language cues.

* **List instructions step-by-step.** In fact, it is advisable to familiarize the students with each step individually and not require them to find the solution from the start. This procedure is ideal for teaching students to solve math and science word problems.

* **Provide frequent summations of the salient points of the lesson** during the class period. Try to use visual reviews with lists and charts. Paraphrase the points when appropriate.

Adjusting Teaching Techniques:

When teaching LEP students, teachers should be more conscious of their speech patterns and tolerant of their students' mistakes:

* **Reduce and adjust teacher talk.** Allow students more time to speak. Concentrate on talking about the subject material rather than the classroom discipline. Be prepared to rephrase questions and information if the students do not understand the first time.

* **Increase the percentage of inferential and higher order questions asked** (questions that require reasoning ability, hypothesizing, inferencing, analyzing, justifying, predicting). The language used need not be complex for thinking skills to be exercised. Model critical thinking skills, a step-by-step approach to reasoning, especially with young children.

* **Recognize that students will make language mistakes.** During the second language acquisition process, students make mistakes, even though they have been taught otherwise. This is natural in the process of learning a language. Make sure that the students have understood the information, but do not emphasize the grammatical aspect of their responses. When possible, though, model the correct grammatical form.

Varying Presentations of Information:

We have suggested the use of multiple media in the classroom to reduce the reliance on language and place the information in a context that is more comprehensible to the students.

* **Bring realia into the lessons**. Have visual displays (e.g., graphs, charts, photos), objects, visitors, and authentic materials, like newspaper and magazine clippings, etc.

* **Do demonstrations** to show the meaning of new verbs, to explain a science experiment, to model language functions in the context of a dialogue, etc.

* **Use filmstrips, films, videos and audio cassettes with books.** Many school districts have media centers from which teachers may get films, etc. Often, they can find ones for a lower grade level which are nonetheless interesting and an excellent means of providing background information.

Increasing Student Interaction:

By actively involving them in the lesson, students can better process the material presented and actively acquire the language as well. Their interest and subsequent motivation will also help improve their performance in class.

* **Use discussion/warm-up sessions** while introducing new topics in class to encourage students to share knowledge they may already have about the topic, along with any relevant real-life experiences they may have had. Build analogies upon their previous knowledge.

* **Have the students do hands-on activities** to manipulate the new material through role plays and simulations, TPR (total physical response), laboratory experiments, drawing pictures and story sequences, and writing their own math word problems, for example.

* **Plan cooperative learning activities.** These paired and group activities (various forms of which are discussed in Jacob and Mattson, 1987 and Kagan, 1986) will promote student interaction and decrease the anxiety many students feel when they must perform alone for the teacher in front of the class. In a heterogeneous classroom, pair language minority students with language majority ones for collaborative work.

* **Use the students for peer tutoring and peer correction.** The students can learn and share among themselves, with the teacher as a facilitator who checks on the students' understanding and progress.

Meeting the Students' Cognitive Academic Demands:

Just as the presentation of new material should build on the students' previous knowledge, the students' cognitive processing and production of the material should build upon skills the students have already mastered.

* **Examine the topic through the students' listening and speaking skills first; then expand the topic through reading and writing activities.** Since the students' oral language skills usually develop more rapidly than their written skills, teachers can check the students' comprehension of the material and clarify any trouble spots before introducing reading or writing activities.

* **Teach the students to use outlines** for pre-reading and pre-writing activities, for making predictions, and for studying. LEP students frequently need assistance in learning how to study. By teaching them study skills, like using an outline, teachers will give the students an important tool that they can use throughout their academic careers.

* **Develop the students' ability to use texts.** Since the acquisition of details within a particular content topic is not the primary objective of the language course, language teachers have more time to develop the students' skills in analyzing:

    1) a text as a whole, by demonstrating how to use the parts of a book to find information passages; and,
    2) passages, by helping students learn to draw inferences, synthesize information, make judgments, and provide justifications.

  However, because these skills are demanded of the students once they are mainstreamed, content teachers need to incorporate activities to develop these cognitive skills into their lessons, too.

* **Plan activities to train the students in attacking academic tasks, such as research projects, problem-solving, and essay writing.** For instance, plan a library project and walk the students through it step-by-step, preferably with peer tutors.

* **Present models for writing assignments,** especially those required by mainstream content classes, like research papers and laboratory reports. Discussing the model is necessary so that the students know how each section is structured and why each section is important. They should be given practice using the model before doing a required assignment with it.

SECTION III

ADAPTING MATERIALS AND DEVELOPING LESSON PLANS

In order to integrate language and content, it is often necessary to use standard text and workbook materials. Indeed, since the LEP students will be mainstreamed, it is desirable to prepare them for such materials beforehand. Unfortunately, the level of the texts and workbooks may be inappropriate for some students. In those cases, teachers may want to consider adapting or simplifying content materials.

This section will explain some practical suggestions for adapting and simplifying materials and for developing lesson plans. In Appendix B some original passages from elementary and secondary textbooks are shown along with possible adaptations, followed by sample elementary and secondary lesson plans that use these adapted materials. Included are sample materials adaptations and lesson plans for elementary science, elementary ESL/social studies, secondary science and secondary ESL/math.

Strategies for Simplifying and Adapting Materials

It is most important to present the main ideas of a passage in a clear and precise manner. The **pivotal pieces of information should be stated first** and wherever possible, in a printed form at that highlights their importance (e.g., bold print, underscoring, outlines, etc.). Stylistic composition is not the goal of adapted materials.

For the sentence and paragraph formation of the adaptation:

* **Put the topic sentence first,** with supporting detail in the following sentences.
* **Reduce the number of words** in a sentence **and the number of sentences** in a paragraph.
* **Word order is important.** There is no need to be fancy with the position of clauses and phrases. Use the subject-verb-object pattern for most sentences.

For the vocabulary terms:

* **Simplify the vocabulary** that will be used, but retain the key concept terms.
* **Do not use a lot of synonyms** in the body of the text.
* **Introduce new vocabulary with clear definitions and repeat** those new words as frequently as possible within the text passage.

For the grammar structures:

* **Use the simpler verb tenses,** such as the present, simple past and simple future.
* **Imperatives** are good to use for materials that require following directions, such as a laboratory assignment.
* **Write in the active voice,** not the passive. For example, instead of writing, "The Declaration of Independence was signed by John Hancock," write, "John Hancock signed The Declaration of Independence."

* **Use pronouns judiciously**, only in cases where their antecedents are obvious.

* **Be careful with indefinite words like "it," "there," and "that"** at the beginning of sentences. Instead of writing, "There are many children working on computers," simply write, "Many children are working on computers."

* **Eliminate relative clauses** with "who," "which," "whom" wherever possible. Make the clause into a separate sentence.

* **Minimize the use of negatives.** Use the negative with verbs, rather than negations like "no longer" or "hardly."

* **Try to preserve the features of the text that convey meaning.** For example, it is important to familiarize the students with sequence markers (e.g., first, second), transition words (e.g., although, however) and prioritizing terms (e.g., most important), since they need to learn how to recognize them. The degree of sophistication for these features, however, depends on the students' language proficiency.

For the content of the adaptation:

* **Use charts and graphs, timelines, photographs and pictures.** Put real graphics into the materials to aid the LEP students' understanding of the prose. Increasing the comprehensibility of the information is not the only goal of using such visual presentations, though. Because academic language is not always linear, students must learn to master methods for discerning and extracting information from charts and timelines.

* **Begin with concrete** examples and explanations and **then move to abstract** concepts and interpretations.

* **Reduce the amount of text** by trying to eliminate some of the unnecessary detail. Focus on the course/lesson objectives determined in the planning stages.

* **Try to relate the material to the students' own experiences.** If possible, change character and place names to reflect the students' own countries. Use examples that may be familiar to them.

Developing Lesson Plans

As exemplified in the sample in both Appendix A and Appendix B, integrated lessons have both content and language objectives. It is often useful to specify critical thinking or study skills to target as well. A teacher's or school district's preferred lesson format can then be used to develop the lesson. Typical phases include warm-up or motivating activities, presentation of new material, in whole group or small group work, discussion or application of new material, some reading/writing activities , a wrap-up or assessment segment to check student understanding and extension activities to reinforce and/or extend the concepts covered. Although not illustrated in the appendices, series of lessons which are thematically linked into units provide for sustained interests as well as the opportunity to build systematically on prior activities.

The exemplary lesson plans deliberately offer an extensive range of techniques and strategies. They demonstrate the possiblities available to teachers for making integrated language and content more comprehensible. It is important to note that teachers teachers may not have time to incorporate all these suggestions into their lesson plans every day, but should try to vary the activities they plan. Certain strategies are more critical than others. These are:

1) the selection of principal vocabulary terms to teach before a reading exercise,
2) the opportunity to discuss the material orally, preferably before any written work is assigned, and
3) the provision of class activities for student-to-student interaction.

It is also worthwhile reviewing the adapted materials to ensure that all major pieces of information are included. The adaptation should not be "watered down," although it is intended to be linguistically simpler and presented in a structure that is easier to comprehend.

SECTION IV

KEY ISSUES IN IMPLEMENTATION

Implementation of this instructional approach occurs in three ways:

1) Efforts for integrating language and content are undertaken by an individual teacher, either language or content, who sees the needs of his/her students and tries to address them.

2) Teams of content and language teachers get together to discuss problems and find solutions. One teacher alone, or two working cooperatively, can use the integrated approach illustrated in this manual.

3) In some cases, this collaborative procedure spreads to several other motivated teachers in a school and, perhaps, the success of the approach attracts the attention of curriculum supervisors and other administrators who wish to implement the approach district-wide. They will frequently plan in-service and/or pre-service workshops and call on other resources available in the district.

The following suggestions for implementation result from insights from past experience confronting a variety of concerns, such as student motivation and achievement, teacher anxiety and conflict with administrative directives and goals. These ideas for teachers and administrators offer a means for moving LEP students more smoothly through the transition from traditional ESL language classes to mainstream content classes.

Cooperation/Collaboration among Teachers

Collaboration typically begins with **classroom observations**. In this way, language and content colleagues can see what problems their counterparts face and how they attempt to resolve them. Teachers should be comfortable with each other and with this activity for the observations to be successful. As an important key to the professional growth of teachers who will employ this approach, each teacher plays two roles during the observations. The first is that of a student. Content teachers, seeking to learn ESL teaching methods, can observe their ESL colleagues in class. Not only do they see some methods in real life situations, but they will also see how the ESL teachers handle discipline and classroom organization. Language teachers, preparing themselves to introduce relevant content, can attend content classes. They can become familiar with methodologies used to present content and to assess the students' comprehension of the material. The second role is that of a trainer. Besides observing colleagues teaching in their traditional manner, the teachers as trainers need to observe them trying out the approach. Comments and suggestions for improvement can then follow.

To enable teachers to discuss and plan lessons, a school should ideally establish a team teaching policy that matches language and content teachers; however, few school systems are organized in this manner. An important key to success is **planning time for content and language teachers to work together**. There should be time allotted before the school year begins to focus on the overall curricula of the courses when the objectives for the classes are defined. The syllabi of the classes need to be planned, including decisions concerning which lessons should emphasize content, and which ones language. The textbooks and supplemental materials need to be examined, so the vocabulary, language functions, and discourse requirements may be incorporated into the syllabi from the start. The sequence of topics that will be presented in separate language and content classes must be structured as well.

The cooperation does not stop on the first day of school. Nor should it be assumed that the teachers, on the basis of some training sessions and a copy of a new curriculum, are adept at using the approach or even have learned all the content topics and language features they will need to address. Throughout the school year, teachers must schedule time together when they can **share their knowledge about the upcoming topics in the curriculum**. Content teachers can familiarize the language teachers with the subject matter they are expected to cover in their course. Language teachers, likewise, can prep their content colleagues to adapt instruction or preview vocabulary and certain grammar items. Further, teachers can write material adaptations jointly and/or review adaptations that have been done separately.

During the first year, a great deal of **assessment and revision of the syllabi** needs to be undertaken during planning sessions. Among the points likely to be raised at these sessions are: clarifications of certain topics, additional teaching methods, assessments of the materials used and the students' progress, brainstorming strategies for the underachieving LEP student, and providing enrichment opportunities for the gifted and talented LEP student.

Administrative Support

The principals play an important role once new curricula are in place. The principals, along with department chairs (if they exist), need to **design the teachers' workday so that joint planning time is included**. The teachers may not have to meet every day, but their free periods should correspond. In the same vein, principals need to arrange release time for teachers to observe their colleagues in class. In some schools that have started using this approach, teacher duty periods are cut, so that the planning time is more flexible. Those districts have hired school monitors to manage such duties as lunchroom supervision and study hall.

Principals and other administrators need to provide encouragement and support. **Joint pre-service and in-service training** for the language and content teachers can be helpful. Periodic sessions offered throughout the school year are also beneficial. In this way, the teachers will have time to try out the approach, discuss problems with it, share successes, and implement new strategies under the year-long guidance of a teacher training consultant. Also, since it is unlikely that all the teachers in a school district will be trained in the approach initially, the administrators must **carefully select the teachers** who will participate.

Additional work needs to be done with guidance counselors in secondary schools who organize the **students' schedules**. When a content and language teacher are paired, the counselors can make certain that the LEP student in one class is placed in the other as well. The question of **credits** for the classes also needs to be resolved. At present, many schools do not give a diploma-required credit for ESL classes. This practice often hinders the LEP students' receipt of a diploma within the four high school years, especially if they start their secondary education at the lowest ESL level. This approach to integrating language and content, however, should help persuade administrators that a required credit should be given for language, as well as content, classes.

Classroom Organization

Physical appearance. The rearrangement of desks into groups, circles or pairs is important for promoting student interaction. Setting up study carrels and learning centers for both enrichment and remedial instruction is recommended. Adding realia to the classroom -- objects on shelves, pictures and photos on walls, student progress charts for specific projects, a small library with books, magazines and newspapers for free reading time -- makes the area more interesting and relevant to the students.

Student preparation. The students will need to be trained for certain "interactivities" (i.e., activities that promote interaction). It takes time and patience on the teachers' parts to accustom students to doing group and paired work. Showing them new activities requires introductory sessions, and may take several attempts, before the students can perform in the desired manner. The teachers, in preparing their lessons, must take into account the extra time the new strategies will demand until everyone is familiar with them.

Heterogeneous classes. There are two types that can be described:

Mixed language minority and majority students - Content teachers need to raise the native speaking students' awareness of the language problems their non-native speaking classmates will experience. By developing their sensitivity, the teachers can expect increased communication and, as they work together, improved cross-cultural understanding among the language groups. Teachers should have the native speaking students serve as peer tutors for the non-native speaking ones.

Mixed levels of LEP students - Frequently, in classes with LEP students, some learn the language and grasp the material more quickly than others. In school situations where quick learners cannot be moved into a higher level class, teachers must amend their lessons, so that those learners will continue to progress and not become bored. Providing them with learning center activities is one solution. Another is to use them as peer tutors or give them individual library and/or computer assignments which will enable them to become the class "experts" who assist their classmates during later class assignments.

Bridging

In schools that only offer ESL language classes and regular content classes, it is often difficult to bridge the gap between the two. Unfortunately, many gifted and talented LEP students are denied enrichment and more advanced content classes because their English proficiency is limited and their cognitive skills are underdeveloped. **Content-based language classes and language-sensitive content classes can help to solve this problem.**

Clearly, students who speak no English need primarily ESL language classes in the beginning, but they can still attend classes that focus less on English, such as physical education, music and art. At the same time, language teachers can start introducing content. After several months, depending on the students' acquisition, they can begin language-sensitive content classes, such as science, math and social studies. Then, they can be slowly mainstreamed into the content classes where they are most likely to be successful, complemented by ongoing content-based language instruction.

Mainstreaming

Once LEP students are mainstreamed, it should not be assumed that they no longer need assistance. Understandably, they will confront situations where they have little background knowledge of the material or will be asked to do a type of report or experiment for which they are unprepared. **Support must still be provided for these students.** They should have access to additional resources, geared to a limited English proficient level, where they can look up information. Their former teachers should make every effort to be available for questions, advice and supplemental help. Establishing a tutorial program, either with peer tutors or adults, is highly recommended.

SECTION V

MODELS OF IMPLEMENTATION

Several school districts have tried implementing the integration of content and language instruction in a variety of ways. First, there is often a course-by-course approach for sheltered classes. In this case the focus of the class is on the subject matter content with one teacher or department addressing both the language and content issues. Second, an entire curriculum is organized to integrate ESL and content with a greater emphasis on language study than found in the sheltered classes. In both of these methods, other departments often observe the success of the approach and attempt to implement the integration as well. Third, some schools have planned a "language across the curricula" or "whole-school" approach. This system expects all teachers to be responsible for the language training of their students.

Sheltered Classes

These classes have commonly been called Sheltered English if taught by an ESL teacher, or Sheltered Content if taught by a content teacher. They are also known as language-sensitive content classes. The model seeks to make academic instruction comprehensible in English to LEP students. While the students are learning the subject matter, they are also acquiring additional vocabulary and language skills (Northcutt and Watson,1986).

In a Sheltered English class, the ESL teacher is responsible for teaching content through courses such as ESL/Social Studies or ESL/Math or LEP students. These classes may be found in elementary and secondary schools. For Sheltered Content, the content teacher becomes sensitive to the language demands of the course syllabus and finds ways to assist the LEP students, although the class may include both native and non-native speakers. These classes primarily appear in secondary schools. Ideally, the ESL teachers and the content teachers would collaborate in planning their syllabi and sharing their materials and techniques.

Integrated Curricula

Content-based ESL curricula can be developed for elementary and secondary grades. These curricula integrate English language instruction with the concepts taught in social studies, science, mathematics, or other curricula. Thus, the content is the vehicle through which the language is learned. The curricula should describe sample vocabulary, language functions and skills, and applicable listening, speaking, reading and writing competencies for specific topics. It can divide the competency requirements not only by grade level, but also by the English proficiency level of the student.

Whole-School Approach

Some school districts, like Queensland, Australia (see Houston, 1986), have developed a "whole-school awareness" system. They have arranged for co-involvement of mainstream and ESL teachers. The teachers form task groups to analyze the syllabi, work programs, textbooks and test questions of six subject areas (English, mathematics, science, geography, home economics, and business principles) in order to identify the language functions and genres (types of texts, rhetorical styles, etc.) found in each.

This model uses a "functional-notional" view as its linguistic framework, where teachers investigate what the learners have to do with the language in order to understand and communicate. Explanations for the functions found at all levels are provided--from the meanings of sentences to the general functions involved in specific subject areas. By organizing commonalities of functions among subject areas, teachers can recognize some need for a coordinated approach across the curricula. The individual teachers, however, are responsible for the subject matter language of their classes, with the exception of these function commonalities.

After discovering the language demands associated with the subject areas, the content objectives of the curricula are reviewed. Teachers prepare topic units to incorporate the functional language perspective and devise exercises and graphic outlines that focus on the language functions. Teachers can also analyze the types of test questions they ask and the features of written responses. This analysis would enable the teachers to find "model" responses that could be presented to the students.

In-service training with coaching can also be incorporated into this system. Classroom observations can be conducted as teachers try out the strategies and follow-up feedback sessions can be held over a period of several months.

When this approach was implemented in Queensland, several positive results were obtained, including:

1) the development of a collaborative relationship between ESL and content teachers;

2) an increase in opportunities for professional exchanges and interaction between secondary and primary schools;

3) clear examples of obvious improvement in students' performance and attitude; and

4) insights gained by the mainstream teachers about language that were found to be relevant and applicable to many of the native-speaking students as well.

SECTION VI

MODELS FOR STAFF DEVELOPMENT

Since professional development is a key to the success of the integration of language and content, this section includes some sample agendas of training workshops that have presented this approach. The workshop leaders help the language and content teachers begin the process of collaboration and help them to recognize the important qualities they can bring to this cooperative venture. The rationale which supports this approach is explained in the workshops, and time is provided for discussions of individual situations. Workshops have been held during half or full-day sessions or week-long seminars.

In any model of professional development, it is important to build in follow-up sessions for assessment, problem-solving and suggestions. The teachers, after having been introduced to this new approach, still need guidance in its implementation. Not all of the potential snags for each teacher can be anticipated at the workshops, so an opportunity to get and give feedback during implementation is essential. A coaching system set up within the schools can address this issue. Fellow colleagues can coach and support one another and discuss problems which may arise.

The first sample agenda describes a half-day workshop in Tuba City, Arizona. Among the presenters were teacher trainers who had been previously trained in the approach and were using it in their classrooms. The workshop focused on the application of the approach to mathematics:

9:00	Welcome and Overview of the Seminar.
9:15	Content-Based Language Instruction and the Language of Mathematics: Presentation of the theoretical background, research findings and approaches currently used in different school districts.
9:45	Language-Sensitive Mathematics Instruction: How one math teacher alters his instruction by modifying his teacher talk and assignments.
10:15	Break and Video of Integrated Language and Content classes in Fairfax County, VA.
10:45	A Math/Language Approach Developed by CAL Math/Language Project Brief "Walk-Through" of Materials Used: Explaining the design and rationale for the exercises in English Skills for Algebra.
11:00	Applying a Math/Language Approach to the Classroom: Examples of implementation of the approach. In the Language Classroom In the Mathematics Classroom
12:30	Wrap-Up Discussion: Math/Language Activities in YOUR Classroom. Discussion of the participants' situations, their problems and needs, and how these materials and approach may fit into their classes.

The following all-day workshop was presented at TEXTESOL II, in San Antonio, Texas. It was composed of a general discussion regarding the rationale and implementation of the approach as well as a practice session for developing a lesson:

Morning Session

8:00-9:45
- Introduction
- Needs Discussion
- How to Write a Topic Unit

10:00-11:30
- Teaching Language Registers and Academic Content: A Rationale, Some General Guidelines for Materials Development, and Specific Applications to Mathematics

Afternoon Session

- Group Sessions
  - Participants will work in three groups: Primary/Elementary (PK-6), Secondary (7-12), Adult
  - Each group will complete two tasks: develop a lesson/topic unit and have group discussions addressing issues and problems on implementing language and content instruction in your own district.

1:00-2:45
- Task 1: Lesson Topic Unit
  - Work with other participants, select topic area, state how the lesson will be organized around the topic, discuss some language development opportunities provided by the lesson/topic unit.
  - Write outline of unit/lesson on butcher paper and display.

3:00-3:30
- Task 2: Group Discussions
  - Some questions to consider:
    - What kinds of integrated language and academic content programs are there in your district?
    - What materials and resources are available in your district?
    - How is language addressed in these programs?
    - How is academic content addressed in these programs?
    - What teaching methods are being used?
    - How are teachers being prepared for these programs?
    - How are these programs being administered?
    - What results are being achieved?

3:30-4:00
- Wrap-Up Discussion--Outlining a Plan of Action
  - Discussion questions:
    - How will you begin to teach language and content when you return to class on Monday?
    - Is there a way you can show other colleagues how to use this approach?
    - What kind of support would you need from your principal/ ESL supervisor/district supervisors to do it right?
    - What kind of long-term plan of action would you like to see?

Two seminars -- one, a week-long session for the theory and curriculum development applications of the approach, and the other, a three-day session for classroom implementation -- are shown in the following agendas. These workshops were offered in Montgomery County, Maryland as part of their summer training. Although the focus was for foreign language immersion, the agenda is also appropriate for ESL and content teachers since immersion teachers teach academic content through a second language.

Curriculum Development Plans for Foreign Language Immersion Teachers
(June session)

Day 1	Introduction and language objectives
Day 2	Teaching content through language: Making the abstract concepts concrete using selected techniques.
Day 3	Teaching content through language: Teaching strategies a. linking concrete experience to abstract language b. increasing the level of abstract language use and concept development c. increasing student-to-student communication
Day 4	Planning, modeling, implementing objectives a. content-based language b. thinking skills c. curriculum development
Day 5	Identification of language objectives: a. content-obligatory objectives b. content-compatible objectives Format for development of curriculum

(August session)

Day 1	Delivery of instruction: Strategies Classroom management: Identifying and implementing essential elements for the class setting
Day 2	Modeling the language: Defining and implementing the feedback cycle
Day 3	Successful second language learners: Identifying and supporting students' learning styles Language growth through student-to-student communication

The Montgomery County school district also planned follow-up training for the teachers during the school year.

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APPENDIX A

STRATEGY SHEETS

The following "strategy sheets" present plans for combining language and content instruction for topics in mathematics, science, social studies, art, music and physical education. They were developed by participants in a seminar on methods of integrating language and content instruction held at the Center for Applied Linguistics in January 1987.

STRATEGIES FOR INTEGRATING LANGUAGE AND CONTENT INSTRUCTION
ART, MUSIC, AND PHYSICAL EDUCATION

Carolyn Andrade, Carol Ann Pesola and Donna Christian

Purpose

A major difficulty in teaching language to beginners is how to get started and how to facilitate the early stages of language learning. The use of physical response strategies can be an effective way to approach this problem, particularly in immersion settings. In this technique, teachers use only the target language, and students are expected to respond physically, but not verbally. In other words, students demonstrate understanding through means other than oral production. The approach shares its conceptual underpinnings with those of the "total physical response (TPR)" and "natural" approaches.

The physical response orientation has a number of advantages for early language learning. It involves processes that resemble natural language acquisition, by developing comprehension and involving action responses and it reduces the level of anxiety in the new language situation. In the classroom, the approach further has the advantage of pairing mental processing with action, which may lead to greater retention, and all students are able to participate. For young children, this involvement orientation is especially important, as is the fact that no reading or writing skills are required (although they may be developed).

Integrating language and content instruction using physical response strategies can be particularly effective in art, music and physical education classes. Concepts appropriate to the age levels of students can be taught, and the content lends itself well to physical rather than verbal responses from the students. The teacher's language can be geared, in variety and complexity, to the language level of the students, while still allowing the teacher to promote concept learning.

The following activities suggest ways in which physical response activities can facilitate the learning of language and basic concepts in music, art, and physical education. The lessons are designed for beginning language learners (in a foreign language or ESL context) in various elementary grades.

The Basic Approach

Step 1: Planning

- o set language and content goals for the lesson
- o determine the vocabulary needed for the lesson
- o break down the lesson/task into steps

  teacher: language + gestures + context
  student: physical responses

- o define sequence of activities
- o identify and gather materials needed

Step 2: Conducting the lesson

- o Teach vocabulary using visuals, movement and demonstration; use familiar commands (*put*, *take*, etc.) and allow for lots of manipulation of vocabulary through novel commands (new combinations of familiar command structures with new vocabulary).

- o Introduce and practice concepts through sequenced activities, with teacher using language, gesture and demonstrations, and students responding with action, first as a group and then in smaller groups or individually.

- o Combine and reinforce concepts, continue practice.

Step 3: Ending the lesson

- o End with a quiet activity to calm students down before the next class; because of the active nature of this approach, it is important to provide the students with a "cool-down" or quiet time before moving on to the next activity; a good example is a short story (told orally or read).

Sample Lessons

I. Physical Education
Objective: motor skills development, sequencing actions
Language level: beginning (foreign language or ESL)
Educational level: primary
Materials needed: music from the culture whose language is being studied (optional for accompaniment to activities)
Activities:
Note: These activities are not intended to constitute a single lesson; the inventory of actions should be built up over time, introducing no more than three actions and two modifiers at a time. As the list of known actions builds, new and old responses should be practiced together.

1. Setting the stage: demonstrate/teach vocabulary
   a. action verbs (*jump, skip, hop, run, walk, stop*, etc.)
   b. modifiers (*left, right, fast, slow, high, low*, etc.)
   c. numbers 1 to 10

2. Demonstrate actions and have children practice each action as a group.

stand up	run	stop
walk forward	jump high	run in a circle
hop 3 times	skip to the left	etc.

3. Give a series of 2 or 3 commands and have children carry them out, as a group and individually.
   jump 2 times and skip to the door
   hop to the teacher and squat down
   run to the door, hop 3 times and walk to the window
   stand up, jump 2 times and sit down, etc.

4. When the inventory of known actions is long enough, play a game. Issue commands and have the students do the actions. When a mistake is made, in action or in number of times, etc., the student must sit down. Start with single commands and gradually increase the number of commands in the sequence. Those children sitting down may participate by monitoring the performance of those still standing.

II. Art
Objective: basic shapes and colors (making a mobile)
Language level: beginning (ESL or foreign language)
Educational level: elementary
Materials needed: colored paper in at least five colors, objects to trace basic shapes (rectangle, square, circle, triangle), pencils, scissors, string, wooden sticks (approximately 18-24 inches long)
Activities:
1. Setting the stage: demonstrate/teach vocabulary
   a. action verbs: *put, take, cut, draw, make, find*
   b. colors: *red, blue, yellow, green, black, white*
   c. shapes: *square, rectangle, circle, triangle*

2. Demonstrate tracing shapes and cutting them from paper of different colors. Have children cut out pieces of various shapes in various colors.
   Find a circle; draw a circle on the red paper; cut out the circle.
   Make a square on the blue paper; cut it out.
   Put the box (rectangle) on the yellow paper; draw the rectangle; cut out the rectangle.
   Make a green triangle.
   Then let children cut out shapes and colors as they choose.

3. Once children have a number of shapes cut out, practice sorting and naming the shapes and colors. Get children moving around as they sort.
   Put all the triangles together. Who has a red triangle? If you have a red triangle, stand up. Put all the red triangles on the table and sit down.
   Who has a black rectangle? Put the black rectangle by the window.
   Put all the blue pieces together. Take the blue squares to the blackboard.
   Continue sorting, then redistribute shapes so that each child has at least 2 of each shape in different colors.

4. Demonstrate glueing strings of different lengths to shapes and tying them to the wooden sticks, more or less evenly spaced. Allow children time to design arrangements of shapes to their liking. With older children, two sticks may be crossed and nailed together to make a more complex mobile.

5. Hang children's work around room and use at later times to practice shapes and colors in follow-up activities.

III. Music
Objective: note values
Language level: beginner (foreign language or ESL)
Educational level: 2nd grade and above
Materials needed: large versions of notes (quarter (8), half (4), and whole notes (2)) for demonstration; equivalent set of notes for each student to work with; flannel boards or other way to put notes up for display and rearrangement
Activities:
1. Setting the stage: demonstrate/teach vocabulary
   a. numbers
   b. names of note values
   c. action verbs: *clap*, *tap*, *step*, *sing*, *jump*

2. Hold up the appropriate note and have the students follow commands using the notes they have.
   Point to the whole note, the half note, etc.
   Put the whole note on the table and clap 4 times.
   Put the half note on the floor and clap 2 times.
   Put the quarter note on your head and clap one time.
   Cover your left eye with the whole note and wink 4 times, etc.

3. Compare values of notes. Hold up whole note, two half notes and four quarter notes, as equivalents. Practice tapping 4 times for a whole note, 2 times for each half note and 1 time for each quarter note. Hold up combinations of notes and have students hold up equivalents, while they tap them out. Encourage innovative combinations.
   For example: Hold up a whole note and a half note; have students tap them out (6 taps); have students find equivalents and tap them out (3 half notes, 6 quarter notes, etc.); continue this practice until students know the values.

4. Practice sequences of notes. Using large demonstration notes, combine whole, half and quarter notes into series and have students tap them out. For example, place 3 quarter notes, a whole note and a half note in a row and have students tap or clap 1 time for each quarter note, 4 times for the whole note and 2 times for the half note. Practice a few sequences.

5. Ask students to work in pairs or small groups to pool their notes and put together a series of notes for the class. Come back together and tap/clap out the sequences proposed by each group/pair.

Variations

All of these activities can be adapted for older students by adjusting the actions or context.

Resources

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STRATEGIES FOR INTEGRATING LANGUAGE AND CONTENT INSTRUCTION SOCIAL STUDIES

Melissa King, Stephen Matthiesen, and Joseph Bellino

Purpose

This strategy introduces and reviews important events, people, dates and concepts in the social studies content area using color-coded sentence strips. As constituents of sentences are manipulated, content information is presented and the following language foci are addressed:

- develop sentence structure and vocabulary
- review WH-questions
- promote oral language proficiency and the transition to reading/writing

Language Level
Beginning to Intermediate

Educational Level
Grade one or higher

Materials

Strips of colored paper and colored cards
Colored markers
Pocket chart (optional) for visual display
Magnetic tape (optional) for display of cards/sentences on magnetic chalkboard or thumbtacks for display on bulletin board.

The Basic Approach

This strategy involves the use of color-coded sentence strips to present content information and develop a variety of language skills.

Step 1: Prepare the following materials:

- color-coded sentence strips with content information which is to be focus of lesson(s)
- color-coded WH-question cards which correspond to specific sentence parts on the colored strips
- color-coded word cards which contain key words/phrases from the target sentences

Example:

Cortez	went from Cuba	to Mexico	in 1519	to look for gold.
blue	red	green	purple	orange

Who	from Where	Where	When	Why
blue	red	green	purple	orange

Alternate question cards:

What was his name?	What country was he from?	What place?
blue	red	green

What year?	What reason?
purple	orange

Step 2: Introduce content information on "World Explorers" to students by

a. breaking target sentences into constituent parts
   - build up sentence constituent by constituent
   - tape or tack strips to board as they are added
   - have students repeat or read constituents as they are added

b. eliciting appropriate responses to WH-questions about the content
   - ask questions about each constituent as it is added, then
   - review by asking basic questions and alternate forms after complete sentence developed

c. eliciting appropriate WH-questions to correspond with given content information
   - point to the answer and have students supply the question

d. distributing question cards and word cards to students for physical response drills
   - Have student with question card stand up and ask, then student with appropriate answer stand up and answer

e. distributing word cards to students so they can reconstruct target sentences by standing up in correct order.

Step 3: Encourage student-student interaction with color-coded cards and sentence strips. Have students pair up to practice with each other.

Step 4: Move from oral practice into writing activities:

a. have students write appropriate content information or WH-question following an oral cue;
b. have students write target sentences when given a word or phrase as an oral stimulus; and
c. have students create new sentences (following the structural pattern) when given additional content information.

Extension

Model other similar sentences for an oral and/or written review.
For example:

1. Cabot went from England to America in 1497 to find a trade route.
2. Cartier went from France to Canada in 1534 to find a trade route.
   Ask questions: who? what country? where? when? why?

Other Uses

This strategy could be easily adapted to other social studies units as well as other content area subjects.

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Note about Series

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STRATEGIES FOR INTEGRATING LANGUAGE AND CONTENT INSTRUCTION
SOCIAL STUDIES

Melissa King, Stephen Matthiesen, and Joseph Bellino

Purpose

This strategy uses visual representations known as "semantic webs" to portray the relationships among various components of a content domain under discussion. Presentation of content via semantic webs helps students develop the skills of organizing information and comparing/contrasting information as related to key concepts. At the same time, language development occurs, through:

- vocabulary development
- practice in clarifying and describing relationships

Language Level
Intermediate to advanced

Educational Level
Grade one or higher

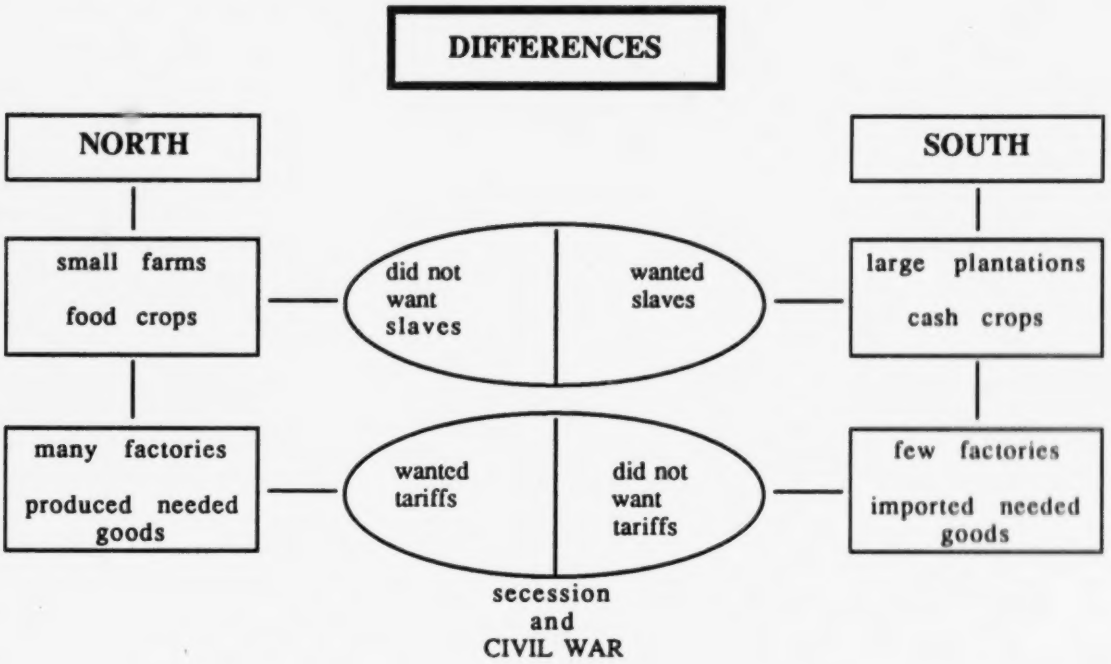
Materials
Paper and pencil
Ruler
Templates with shapes/configurations (optional)

The Basic Approach

This strategy entails the use of a visual scheme to represent relationships among important events, people or other historical facts and concepts; for example, the following content focus can be considered:

> DIFFERENCES between the North and the South led to disagreement over socio-economic policies and eventually led to the secession of the Confederate states.

Step 1:
- Review the unit to be studied and identify key concept(s).
- Determine important relationship(s) in the unit and list the target vocabulary.
- Sketch a visual diagram to represent this information, as shown below.
- Assign students a unit to read.



Step 2: - Present this semantic web to students.
- Encourage student discussion of content and concepts represented.
- Ask questions like
  What states are in the North? in the South?
  Where are there small farms? large plantations?
  What are crops? goods? tariffs?
  Who wanted slaves but did not want tariffs?
- If appropriate to student level, ask them to generate sentences and/or a paragraph to explain relationships illustrated in the web, or to read a related text.

Step 3: - Ask for elaboration of ideas represented in web. For example, ask students which major differences between the North and South led to war.
- If a related reading has been assigned, present a blank web or one with gaps and ask students in groups to fill in details based on this reading.

Other Uses

This strategy could easily be adapted to other social studies units as well as other content area subjects. It can serve as a prereading as well as a review activity. This strategy is excellent for developing pros and cons, for clarification, and for analysis of paragraphs into major ideas and supporting ideas.

Author Information

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STRATEGIES FOR INTEGRATING LANGUAGE AND CONTENT INSTRUCTION SCIENCE

Patricia Chamberlain, Mary Ellen Quinn, and George Spanos

Purpose

This strategy can be used to integrate language and content instruction in science classes with a laboratory focus. The approach takes standard laboratory experiments and integrates language learning. The following activity illustrates the implementation of the strategy at the primary school level for the specific scientific concept: "Air has pressure because it weighs something."

Materials

The materials necessary for this experiment are:

water	pencils and paper
towels	medium size glasses (glass or plastic - styrofoam doesn't work)
pans or sinks	stiff cards of various sizes, e.g., index cards

The Basic Approach

For students at *beginning proficiency levels*, conduct the following experiment (Steps 1-7). The steps for the basic experiment are appropriate at the elementary school level. The primary cognitive focus is observation, which can be expressed linguistically through simple unstructured discussion and/or note-taking activities, and by asking yes-no questions or giving imperatives.

Step 1: Write on the board and state orally: Air has pressure because it weighs something.
Step 2: Put water in the glass until it comes to the top.
Step 3: Push the card over the top of the glass.
Step 4: Hold your hand over the card. Turn the glass of water upside down. Be sure to leave your hand on the card.
Step 5: Remove hand and ask students to comment on what they have observed, eliciting relevant vocabulary and concepts.
Step 6: Divide class into small groups (2-3 students each). Each group is asked to re-enact the experiment, keeping a record of when it does and doesn't work.
Step 7: Re-convene class and have group members relate results.

Extensions

The instructor may want to incorporate some higher level cognitive foci at the *intermediate proficiency level*. In that case, the following steps may be added to the basic experiment.

4b. Ask them to predict what will happen.
6b. Tell groups to record results on a prepared form which classifies what happens under different conditions. For example:

- glass not filled to the top with water _____
- card not large enough to fit over rim _____
- hand removed too quickly _____
- card not stiff enough _____
- glass made of styrofoam _____

7b. Ask students to relate what happened under the varying conditions and to provide an explanation.

At the *advanced proficiency level*, the experiment can be expanded to include the following steps:
6c. Have each student write his/her own conclusion(s)
6d. Assign a group recorder the task of collecting all the conclusions, writing down, and reporting to the group the various conclusions. Students in each group then add hypotheses and conclusions.
7c. Have each group make a report to the class. This may be structured according to a standard report form.
7d. Collect written group reports and return them at a later date with comments and perhaps allow for further discussion.

Variations

A related activity would be to take an empty clear glass, turn it upside down and push it down into a pan of water. Demonstrate that the water doesn't go into the glass (or only slightly), because air pressure prevents it. Use similar steps as above, eliciting verbal responses and explanations from the students at the appropriate level of proficiency. Variations will, of course, depend upon whether the class is an ESL class or a mainstream class, as well as upon the nature of the specific experiment being used.

Other Uses

This same strategy can be used for the secondary and tertiary levels (see Table below). The *language foci* may be altered to include more sophisticated activities such as library work, science reports and projects, mastering technical vocabulary, and so on. The same experiment can also include additional *cognitive foci* to develop more complex or higher order thinking skills, such as hypothesizing, synthesizing, and experimenting.

The following table summarizes how lessons can be created for different grades and proficiency levels through the implementation of language foci (lf) and cognitive foci (cf) for each grade/proficiency slot.

TABLE: TEACHING SCIENTIFIC CONCEPTS

	LOW	INTERMEDIATE	ADVANCED
Primary (4th-5th)	cf: observation lf: unstructured discussion, note-taking, yes-no questions, listening for main ideas	cf: explaining, inferring, predicting lf: structured discussion, structured note-taking, if-then (real), future tense, passives, adjective clauses	cf: hypothesizing, synthesizing, experimenting lf: structured group work, structured reports, if-then (real, unreal), quantifiers, modal verb phrases, noun clauses
Secondary (9th-10th)	cf: observation lf: unstructured vocabulary recognition, library work, illustrating conclusions	cf: explaining, inferring, predicting lf: pre-reading, guided reading, writing informal conclusions	cf: hypothesizing, synthesizing, experimenting lf: writing/expressing complete conclusions, completing standard reports, doing science projects
Tertiary	cf: observation lf: mastery of key vocabulary	cf: explaining, inferring, predicting lf: mastery of technical vocabulary, technical reading, lecture and note-taking skills	cf: hypothesizing, synthesizing, experimenting lf: synthesizing lectures in writing, using science journals, writing technical reports

Author Information

Patricia Chamberlain is a teacher trainer at the Illinois Resource Center. She has been involved in developing content area curriculum for limited English proficient students as a teacher, a consultant and a college instructor.

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STRATEGIES FOR INTEGRATING LANGUAGE AND CONTENT INSTRUCTION MATHEMATICS

Gilbert J. Cuevas, Theresa Corasaniti Dale, Richard Tokar, Gina Richardson and Karen Willetts

Purpose

The set of activities presented below is a sample of how mathematical concepts and skills can be integrated into language learning so that students learn the academic language necessary for mathematics instruction.

The activities presented here deal with the mathematical topic IDENTIFYING GEOMETRIC SHAPES AND THEIR ATTRIBUTES. The activities are arranged from simple to more complex tasks both in terms of content and language proficiency. Thus, although they are grouped for age-grade appropriateness, they are also grouped according to low, intermediate, and advanced language proficiency levels. Each activity in the series builds on the previous one and can be adapted for students in the various grades according to language proficiency.

Grades 1-2	**content focus:**	identifying shapes
(novice)	**language focus:**	labeling shapes

Materials

A class set of attribute blocks, or sets of cardboard shapes that differ by size, color, and shape

The Basic Approach

1. Divide students into small groups, each with a set of attribute blocks or cardboard shapes. Ask students to divide the blocks into 3 groups. (Students should discover on their own that the attributes are color, shape, size).
2. Leave each student with a set of blocks that differ only in shape (not in color or size). Name the shapes: "This is a circle. What is this?" Have the students answer until they learn the names of the various shapes. "This is a ____."
3. Provide additional practice by giving simple commands: "Put the square on your head. Hold the triangle in your left hand."

Extensions and Variations

1. Provide written labels on cards. Have the students match attribute blocks to word cards. Students can work in pairs.
2. Have students write the word for each shape that their partner shows them.
3. Have students practice with worksheets which require them to draw or label shapes: Draw a red circle. Label the square.

Grades 3-6	**content focus:**	identifying common attributes through set
(low intermediate)		intersection
	language focus:	describing, giving reasons

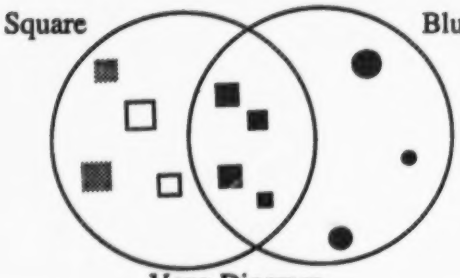
Materials

Sets of attribute blocks or cardboard shapes
Flannelgraph with construction paper shapes

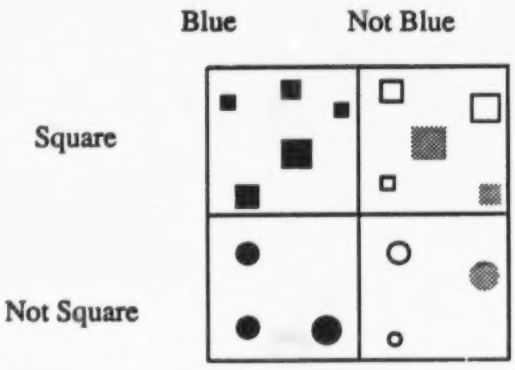
The Basic Approach

1. Divide students into small groups. Have the students divide their set of attribute blocks into two groups, e.g. all shapes that are squares and all shapes that are blue. Illustrate what they have found on the flannelgraph.

2. Ask students if some of the blocks could belong to both groups or sets, e.g. the squares that are blue. "Are there some blocks that can belong to both sets? What are they? Why can they belong to the first set? to the second set?"
3. Explain the meaning of mathematical terms such as set, intersection, and complement. Have students give their reasons for the intersection of the sets, e.g. "Because these are squares and they are blue."
4. Ask students other questions about the elements of the sets. "How many yellow elements are there in the complement? What squares are not in the intersection?"
5. Illustrate the intersection of the two sets with a Venn Diagram or a Carroll Diagram.



Venn Diagram



Carroll Diagram

Extensions and Variations

1. Have students make attribute chains with a set of blocks. For example: "Put a small blue circle on the table. Find a shape that is different in only one way." Have the student put his/her choice next to the blue circle, e.g. a small red circle. Have the other students state whether they agree that this choice is one different or not. "Yes, because they are both small circles; the only difference is color." Continue the chain, with students providing reasons for their choices.
2. Then change the chain pattern to two different (e.g. medium red triangle, then a small blue triangle), and finally three different (e.g. small yellow circle, then a big red square). In each case have students provide the reasons for various sequences of shapes: e.g. "The second element matches the first in color and shape; the third matches the second in shape and size," etc. This activity can become a game for small groups, and students may try to "trick" each other by putting down a wrong block to get rid of theirs first or by giving a wrong reason.

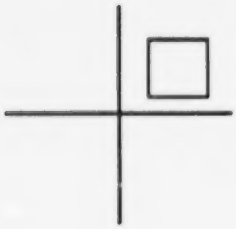
Grades 7-8 **content focus:** graphing shapes
(high intermediate) **language focus:** giving and following directions

Materials

graph paper, ruler for connecting points

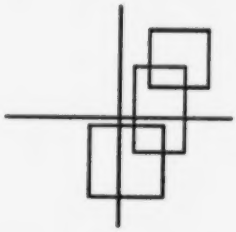
The Basic Approach

1. Have students work in pairs. Each student faces his partner, with a stack of books or other barrier between them. The first student is given a shape(s) made by connecting points on a graph; s/he must give directions to the second student such that s/he may reproduce the design(s) on his/her own graph. "Draw points at coordinates (2,1), at (5,1), at (2,4), and (5,4). Connect coordinate (2,1) with coordinate (5,1)," etc. Have students compare their graphings to see if instructions were given/followed correctly. (See diagram on the next page.)
2. Partners then switch tasks, working with a new graph.
3. The task may be written as well. Have one student write the instructions for the others to follow.



Extensions and Variations

To encourage precision in giving and following instructions, use graphed shapes in increasingly complex configurations; for example, a design of overlapping shapes.
Example:



Grades 9-12 (advanced) **content focus:** classification of shapes by attribute
language focus: stating mathematical definitions

Materials

representations or illustrations of shapes

The Basic Approach

1. Display familiar shapes--square, triangle, rectangle. Have students identify relevant criteria for describing geometric shapes (number of sides, relative length or position of sides, measurement of angles, etc.).
2. Provide students with an example of a definition for geometric shapes and have them discover the constituents necessary for an accurate definition.
3. Give illustrations of definitions which provide too little or too much information and have students explain what is/isn't needed.
4. Work with class to arrive at various mathematical definitions: "A square is a geometric shape having four equal sides and four right angles."

Extensions and Variations

Display and identify unfamiliar shapes. Have students provide definitions, e.g. pentagon, rhombus, parallelogram, trapezoid, etc. Have students divide shapes into families and define the characteristics of each group.

Working with Students at Different Proficiency Levels

Language and mathematics teachers who want to use classroom activities that integrate language and mathematics skills will realize that they need to know something about their students' level of skill/knowledge in both mathematics and the language being used for the lesson. (It is assumed that the language used is the students' second language, either English or another second or foreign language.) Specific instruments for diagnosing students' math skills and language proficiency (particularly reading in L2) will not be treated here. Math and language teachers will have to use their expertise in their respective disciplines to help each other determine each student's skills level in math and in language. However, it might be helpful to think of students as falling into the following four broad categories, as outlined in the figure below.

MATH SKILLS	LANGUAGE SKILLS: LOW	LANGUAGE SKILLS: HIGH
HIGH	Students have near-grade level math skills, but a low proficiency in L2. Example: New arrivals to U.S. who have studied math at grade level in L1 in their native countries. Also, students in lower level FL classes who are at least fair students of math but beginning students of the L2. These students need to learn and practice the language needed for doing math in L2.	Students have strong math skills and high level of proficiency in L2. They should be able to follow regular math curricula in L2. Example: "graduates" of advanced levels of ESL or of FL immersion programs who also are working at or above grade level in math. These students can review these activities either to reinforce the math concepts or for extra language practice.
LOW	Students have weak math skills even in L1 and have low proficiency in L2. Example: New arrivals to the U.S. who had little or no schooling (or interrupted schooling) in their native countries and who have little or no proficiency in English (their L2). These students need intensive help simultaneously (especially in the upper grades) in both math and the L2.	Students have weak skills in math but apparently adequate skills in L2. Example: non-native English speaker who learned English in the first years of school in the U.S. This student speaks English well but probably is underachieving in both reading and math. Also: student in a FL immersion program who is proficient in L2 but is having trouble in math in L1, L2 or both. These students' math difficulties might partially stem from problems with the language of mathematics. Math/language activities such as the ones suggested here might be a new way to address their problems.

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APPENDIX B

SAMPLE MATERIAL ADAPTATIONS AND LESSON PLANS

Elementary Science

The following is a copy of the original passage from a fifth grade science textbook and an adaptation which a content teacher could use in his/her lesson. A sample lesson plan with this passage is provided afterward. It would be appropriate for students with an advanced beginner to intermediate level of English. Illustrations from the original are not included but should be carried over and, if possible, expanded on in adaptations.

[From *Science*, Grade 5 (pp. 36-37). Copyright © 1986 by Scott, Foresman and Company, reprinted by permission of the publisher.]

How Are Plants Alike and Different?

This tree is so tall that you can barely notice the man standing next to it. The plants in the other picture are so small that you could hold hundreds of them in your hand. But these and all other plants are alike in certain ways.

All plants share four traits. First, all plants are made of many cells. Like animals, no plant has just one cell. Second, a plant cell has a **cell wall**--a stiff covering around the cell, as the picture shows. The sturdy cell walls make wood hard and celery tough and stringy.

Third, plants can make their own food. To make food, plants use light, water, the gas carbon dioxide, and **chlorophyll**--a green material in the leaves and other parts of the plant. Chlorophyll gives plants their green color. The food-making process is photosynthesis.

Fourth, plants are usually fixed in one place. They cannot move around as animals do. But they can move in some ways, such as the way a Venus's-flytrap closes its leaves to catch an insect.

All plants are alike in some ways, but they differ in other ways. Plants differ in the ways they reproduce. Some plants, such as this cherry tree, grow from covered seeds made in flowers. Other plants, such as pine trees, grow from uncovered seeds on cones, like those in the picture. Some plants have no seeds. The fern in the picture is one kind of plant without seeds.

Plants also differ in their structure. Many plants contain transport tubes that carry water and food. Some of the tubes carry water from the roots to the top of the plant. Other tubes carry food from the leaves to the stem and roots. Some types of plants have no transport tubes. Water and food move through these plants by moving from one cell to the next.

Adaptation: **How Are Plants Alike and Different?**
Some plants are very tall. Some plants are very small. But all plants are alike in four ways:

1) All plants have **many cells.** All animals have many cells too.
2) A plant cell has a **cell wall.** It is a hard covering around the cell. Wood and celery are plants. They have cell walls. Wood feels hard. Celery is tough and stringy.
3) Plants can **make their food.** The plants use light, water, carbon dioxide (a gas) and chlorophyll. Chlorophyll is a green material in the leaves. It is in other parts of the plant too. It gives the plant a green color. Photosynthesis is the name for making food.4) Plants usually **stay in one place.** They do not move from one place to another place like animals. They cannot walk or fly.

Plants are different in two ways:

1) **Reproduction.** Some plants grow from seeds in flowers. These seeds are covered. An example is an apple tree. Some plants grow from seeds in cones. The seeds are not covered. An example is a pine tree. Some plants have no seeds. An example is a fern.

2) **Structure.** The inside parts of plants are different. Many plants have tubes to move water and food. Water goes from the roots to the top of the plant. Food goes down from the leaves to the stems and roots. Some plants do not have tubes. Water and food move from one cell to the next cell.

In adapting the textbook passage, the sentences and paragraphs were shortened to include the essential information. The new format, like an outline, makes it easier for the LEP student to read and the bold print highlights important points. The dashes and relative clauses were removed to make the sentences clearer. Words, such as some and all, are not used alone as the subjects of sentences; instead, the noun **plant** follows them so that the student knows the reference immediately.

A Science Lesson Plan:

Objectives — Content focus: Similarities and differences of plants
Language focus: How to describe and provide detail

Preparation — Desks are set-up in small groups, students have drawing paper and crayons, lesson adaptation is listed on butcher paper,overhead transparency, handout or blackboard, and a copy of an animal cell is prepared in order to hand out.
Bring in some plants and/or pictures of plants.

Warm-Up — Teacher asks several students to describe a plant. Asks some to compare a tree and a flower. Asks questions like: Is it easier to step on grass or on a tree? Why? Is it harder to eat celery or a tomato? Why? Why do we have plants? Do plants need food too?

Group Work — Groups draw three or four different plants. They find two things or more that are the same about the plants. They find two or more things that are different about the plants. They compare plants to people. Students make a group list of their observations.

Discussion — Discuss the groups' findings.Teacher shows more pictures of plants and/or real plants. If available, the teacher can use a microscope to show slides of different animal and plant cells. List the similarities and differences that the students discovered on a blackboard or transparency.

Vocabulary — Introduce terms: cell wall, carbon dioxide, chlorophyll, photosynthesis,
cell wall--use a drawing, refer back to discussion with celery and tomato, ask for other examples of hard and soft plants
carbon dioxide--do a breathing demonstration and talk about oxygen and carbon dioxide
chlorophyll--give a definition and ask: if people had chlorophyll in their bodies, what color would they be?
photosynthesis--give a series of drawings about the process, refer to discussion about plants needing food

Reading	Have students read the adapted passage. Ask the groups oral and/or written comprehension questions. If written, have groups discuss the answers and present their consenus. Hand-out a copy of an animal cell. Ask groups to make it into a plant cell.
Wrap-Up	Review the similarities and differences.Play twenty questions where a student thinks of one plant and the others ask yes/no questions to guess what it is.
Extension	For homework, have students write brief descriptions of two plants in their homes. Remind them that many foods are plants, so they are not restricted to houseplants.

Elementary ESL: Social Studies

The following passage comes from a third grade social studies textbook. The adaptation has been done by an ESL teacher in order to teach the structures planned for the lesson, in this case, the past tense of regular verbs. It would be appropriate for students with an advanced beginner level of English.

[From *Communities* (pp. 222-223) (HBJ Social Studies), Landmark Edition, by Stephanie Hirsh, copyright © 1988 by Harcourt Brace Jovanovich Inc., reprinted by permission of the publisher.]

Columbus Sails to America

In 1492, almost 500 years ago, **Christopher Columbus** sailed from Spain, in Europe. Christopher Columbus wanted to find a new way to get to China from Europe. He decided to try to cross the Atlantic Ocean.

Columbus and his crew did not reach China. Instead, they found a land that people in Europe did not know about. They found the land that we call America.

The day that Columbus first landed in America was October 12, 1492. Today we have a holiday in October to celebrate the landing. It is called **Columbus Day**. On that day we remember when Columbus landed in America.

Adaptation: **Columbus Sails to America**

In **1492** Christopher Columbus sailed from **Spain**. Spain is a country in Europe. Columbus wanted to find a new way to go to **China**. China is a country in Asia. Columbus decided to go across the **Atlantic Ocean**.

Columbus and his **sailors** did not reach China. They arrived at a new land. Columbus arrived in **America**. People in Europe did not know about this land.

Columbus landed in America on **October 12, 1492**. Today we have a holiday in October. **The holiday is called Columbus Day.**

In the adaptation only the past tense of regular verbs is included. So, words like was and found are excluded. The negative past form is also given. The relative clause with that is removed. Spain and China are explained as countries in different continents in their own sentences. The bold print highlights new words and important points.

A sample ESL lesson:

Objectives	Content focus: History of Columbus' journey to America, geography, discuss an American holiday Language focus: Past tense of regular verbs, introduce negative form of past tense
Preparation	Prepare a copy of the lesson adaptation on a hand-out, blackboard, overhead transparency or butcher paper; obtain a world map with Spain, China and San Salvador indicated and pictures of different modes of traveling; arrange desks in pairs; prepare index cards with a regular verb and another explorer or country or place/object listed (e.g., Vasco de Gama, sail; visit, Spain; John Cabot, live); and a cloze exercise that copies the reading passage, but removes the regular past verbs and new words (e.g., "In 1492, Columbus _____ from Spain. Spain is a country in _____.").
Warm-Up	Ask students what holiday we have in October. Ask students to share their knowledge of Christopher Columbus. Show the students pictures of modern travel on planes and earlier travel on ships. Ask the students what time period or years these pictures represent. Ask students how people travel across an ocean. Ask students if people traveled in planes 500 years ago.
Vocabulary	Teach Spain, China, to sail, sailors Spain and China--show countries on the map, tell the nationality names and languages (Spanish, Chinese), ask if students know anyone from these countries, ask if students know either of the languages. to sail, sailors -- use pictures of a boat sailing on water, draw people working in the boat; ask if students have ever been on a boat
Grammar	Introduce the past tense of regular verbs; show the formation of V+ed. Ask questions to elicit the past tense responses, such as: Are you playing outside now? Did you play outside yesterday? Does Columbus live now? When did he live? When did you arrive in America?
Reading	Have students read the adaptation about Columbus. Ask students comprehension questions--try to elicit the past tense in the responses. Pair students and have them write (or circle) any past tense verbs they can find. Point out the negative past form if necessary, but wait until the next lesson to teach it. Ask pairs to try to describe how Columbus traveled and share ideas with the class. Ask higher order questions like: Did Columbus go to China? Why or why not? Do you think Columbus and his sailors were confused? What is one reason why they wanted to go to China? Why didn't they take an airplane? Discuss the Columbus Day holiday.
Wrap-Up	Hand out several of the prepared index cards to each pair of students. Have pairs write sentences in the past with the words on the cards. Have pairs read their sentences aloud to the other students. Discuss the similarities and differences of the sentences.
Extension	Have students do cloze exercise for homework.

Secondary Science

The following is a copy of an original passage from a junior high school physical science textbook and an adaptation which a science teacher could use in a lesson plan. The lesson would be appropriate for students with an intermediate level of English.

[From *Focus on Physical Science* (pp. 24-25), by Charles H. Heimler and Jack Price, copyright © 1981 by Charles E. Merrill Publishing Company, reprinted by permission of the publisher.]

WORK

Mowing a lawn is work. Washing a car and lifting weights are other examples of work. In science, work has a precise definition. **Work** is the product of the force applied to an object and the distance the object moves.

work = force x distance

$W = F \times d$

Force is measured in newtons and distance is measured in meters. The unit for work is the **joule** (J). One joule is the amount of energy or work required to maintain a force of one newton through a distance of one meter. If you lift a box 1 meter using 10 newtons of force, you do 10 joules of work.

EXAMPLE

A force of 100 newtons is applied in lifting a concrete block 1.5 meters. How much work is done in lifting the block?

Solution:

(a) Write the equation for work.

$W = F \times d$

(b) Substitute the values for force and distance given in the problem.

$W = 100\ N \times 1.5\ m$

$W = 150\ Nm = 150\ J$

MAKING SURE

1. A suitcase which weighs 60 newtons is lifted 0.5 meter. How much work is done in lifting the suitcase?
2. A force of 14 newtons is used to push the suitcase in problem 1 a distance of 0.5 meter across the floor. How much work is done?
3. Which is more work, lifting a suitcase 0.5 meter or pushing it a distance of 0.5 meter? Why?

Adaptation: **WORK**

I.

Some examples of work are: mowing a lawn, washing a car, lifting weights.
We put some force on an object. The object moves some distance. This is work.
The formula for work is: **work = force x distance**, or **W = F x d**.
We use these symbols: work = W, force = F, distance = d.

We measure force with **newtons** (N).
We measure distance with **meters** (m).
We measure work with **joules** (J).

II.

A joule is an amount of energy or work. One joule is the force of one newton for a distance of one meter. You can lift a box 1 meter with 10 newtons of force. This is 10 joules of work.
(10 J = 10 N x 1 m)

EXAMPLE

1. A force of 100 newtons is applied in lifting a concrete block 1.5 meters. How much work is done in lifting the block?
2. A suitcase which weighs 60 newtons is lifted 0.5 meter. How much work is done in lifting the suitcase?
3. A force of 14 newtons is used to push the suitcase in problem 1 a distance of 0.5 meter across the floor. How much work is done?
4. Which is more work, lifting a suitcase 0.5 meter or pushing it a distance of 0.5 meter? Why?

(The solutions will be part of the lesson plan.)

In the adaptation, the organization of the material was simplified. The examples are categorized as such and given in list form (examples of work are: ..., these symbols: ...). An explanation is given for each symbol. The sentence structures are less complex; for instance, the conditional sentence (If you...) has been changed and repetition is used (We measure...). The problem wordings have been kept the same, because the LEP students must be able to manage test questions. The solution, though, has not been included in the adaptation, because the method for solving the problem is an integral part of the following lesson plan.

A sample Science lesson:

Objectives — Content focus: The scientific formula for WORK and problem-solving applications
Language focus: Functions--identifying cause and effect; the language of equations.

Preparation — Desks are set up in pairs; copy the reading adaptation on the blackboard, a handout, an overhead transparency, or butcher paper; bring in some magazine pictures, photographs, and drawings illustrating clear examples of work and non-work and some not so clear-cut (such as someone mowing a lawn, putting furniture into a moving van, throwing a baseball, vacuuming, picking up a small child or animal, someone sleeping, someone thinking, etc.), and a ball and/or suitcase.

To teach students to solve problems, break each solution down into substeps. Teach one or two substeps per lesson. For example, make 2 worksheets with one problem substep. List the substep at the top of each sheet. Each worksheet has two versions-- one for the tutor, one for the tutee.

Examples: Worksheet #1 [Tutor version has correct answers marked with (X); tutee version does not.]

Decide what you are looking for. What does the problem ask you to find?

1. A force of 14 newtons is used to push the suitcase in problem 1 a distance of 0.5 meter across the floor. How much work is done?

1A) What are you looking for in problem #3?
   a. the distance the suitcase moved
   b. the force used to push the suitcase
   c. the work done when the suitcase is pushed (X)

1B) To solve this problem you need to know the force to push the suitcase and:
- a. the distance the suitcase moved (X)
- b. the work done
- c. how long it took to move the suitcase

Examples: Worksheet #2 [Tutor/tutee versions same as #1.]

Identify the information in the problem. What do you already know?

1. A force of 100 newtons is applied in lifting a concrete block 1.5 meters. How much work is done in lifting the block?

1A) How high was the block lifted?
- a. 100 meters
- b. 1.5 meters (X)
- c. 15 meters

1B) Lifting the block used what force?
- a. 100 newtons (X)
- b. 150 newtons
- c. 1.5 newtons

(The teacher should write additional problems too.)

Warm-Up — Ask the students what "work" is. Have them discuss jobs and school or homework. Ask for other examples of work, then display the pictures. Ask the students to identify which ones show work. If the person in the picture is thinking about a history assignment, is s/he doing work?

Have students, one by one, do a variety of activities and in each case, ask the class if this is work. Activities include: move a desk, bounce a ball, pretend to carry a suitcase while walking to an airplane to go on vacation, etc.

Do not draw any conclusions for the students at this point.
Leave the pictures on display.

Vocabulary — Teach the following: lifting weights, concrete block, force, joule, newton

lifting weights-- through pictures or demonstrations
concrete blocks--visuals, perhaps the classroom wall
force--use a demonstration, synonym = power; what can pull something with more force, a baby or a 200 pound man?
joule--give the definition: a scientific term to measure work (Ask students what terms measure distance, time, etc.)
newton--give definition: a scientific term to measure force

Reading — Explain that the scientific definition of work is different from what most students would expect. Have the students read the first two sections of the adaptation.

Pair Work — After they read the two sections, have the paired students look at the pictures again and list the ones that show work. Discuss the results as a class. Ask for some justification from the students, i.e., if that is work, what is the distance? What force was used? For a picture not chosen, ask why not.

To get students to identify cause and effect refer to the pictures and ask questions like: What is the effect of pushing a lawnmower? Why carry the furniture to the van? What will the van look like when the movers are finished? What will the home look like? The baseball is in the catcher's hand; how did it get there? What caused the dishes to be clean and dry, etc. See if any students can ask their classmates similar questions.

Problem Solving — Have students read the rest of the adaptation. Explain the example in the reading and the symbols in the equation. Hand out the worksheets. Tell the students it is important to think about each problem first. It is not always necessary to find the solution right away. Each worksheet will show them one step for solving the problems.

Choose one student in each pair to be the tutor; the other, the tutee. Let the students do the worksheets in pairs with the tutors doing the correcting, not the teacher. Switch roles with the second worksheet.

Homework — Have the students try to find what to use for **W**, **f** and **d** in those four problems. If you think students are ready, ask them to write two problems of their own and solve them for the next class. Have them tell what work is done in their problems and what caused it to happen.

Secondary ESL: Mathematics

The following is a copy of sections of an original passage from a high school algebra textbook (not all examples and problems are included) and an adaptation which a ESL teacher could use in his/her lesson plan. A sample lesson is provided afterward. It would be appropriate for students with a lower intermediate level of English.

[From *Beginning Algebra*, Third Edition (pp. 111-114), by Alfonse Gobran, copyright © 1983 by PWS-Kent Publishing Company, reprinted by permission of the publisher.]

Percentage Problems

Sometimes the relation between two numbers is expressed as a percentage. Percent means "per hundred" and is represented by the symbol %. Thus,

$$30\% = 30 \div 100 = 30 \times \frac{1}{100} = \frac{30}{100}.$$

$$500\% = 500 \times \frac{1}{100} = 5.$$

1. To find what percent one number is of another, divide the first number by the second number, multiply the quotient by 100% and simplify.

Example: 18 is what percent of 30?

Solution: $\frac{18}{30} \times 100\% = 60\%$

2. Most business problems and mixture problems involve percentage. In this section we deal with business problems.

Example: A radio cost \$80. What is the selling price if the markup is 20% of the selling price?

Solution: When the markup is calculated on the cost, let the cost be x, but when the markup is calculated on the selling price, let the selling price be x.

Let the selling price = \$x.
Markup = \$20%x.

Selling price minus the markup gives the cost.

$x - 20\%x = 80,$

$100x - 20x = 8000,$

$x = 100.$

Selling price = \$100.

Example: The selling price of a range is \$200. What is the cost if markup is 25% of the cost?

Solution: Let the cost = \$x.
Markup = 25%x.

Cost plus markup on cost is equal to the selling price.

$x + 25\%x = 200,$

$100x + 25x = 20{,}000$

$x = 160.$

Cost = \$160.

Adaptation: Percentage Problems

I.

Percent means "per hundred." One percent is one part out of one hundred, or $\frac{1}{100}$.
We use the symbol **%** for percent.
One percent is written as 1%.
A percentage tells us the relationship between two numbers.
$\frac{30}{100}$ means 30 ÷ 100. We can write it like this: 30%.

"÷ 100" is also " x $\frac{1}{100}$ ".

500% = 500 ÷ 100 = 500 x $\frac{1}{100}$. This equals 5.

II.

In word problems with percent:

"**is**" means equals
"**of**" means multiplication
"**what percent**" means *x*%.

Example: 18 is what percent of 30?

Solution: $18 = x\% \times 30$.

$$x\% = \frac{x}{100}$$

so, $18 = \frac{x}{100} \times 30$

$$1800 = x \times 30$$

$$\frac{1800}{30} = x$$

$$60 = x$$

III.

We use a lot of percent problems in business. A seller wants to make money. He pays one price for the item. This is the **cost** to him. He will charge a higher price for the customer. He adds a **markup** to the price. The customer's price is the **selling price. The cost** plus the **markup** is the **selling price** (c + m = s). In word problems, **c** can be **cost**, **m** can be **markup**, and **s** can be **selling price.**

Example 1: A radio cost $80. What is the selling price if the markup is 20% of the selling price?

In this problem, the cost is $80 (c = 80). The markup is 20% of the selling price (m = 20% of s). The selling price (s) is: s = c+ ms = $80 + .20s

Example 2: The selling price of a range is $200. What is the cost if markup is 25% of the cost?

In Example 2, the selling price (s) is $200. The markup (m) is 25% of the cost (c). To find the cost, we start with: c+ m =s
c + .25c = 200

In the adaptation, some of the vocabulary was simplified (for example, expressed and represented are changed) as were the sentences. Similar terms were explained clearly, step-by-step, rather than as a series of equations equal to one another. The concepts of cost, markup and selling price were put into a paragraph to help clarify their meanings. The problem solutions were taken out, since those are more directed to the content class, but an explanation of how to set up each problem was included.

A sample ESL lesson:

Objectives Content focus: How to read percent problems (but not necessarily solve them; that is better left for the math teacher)
Language focus: Functions--asking questions

Preparation Divide the class into six groups and arrange the desks. Make a set of cards for a game of concentration, pairing
15% and $\frac{15}{100}$; $4 \times \frac{1}{100}$ and 4%; 75% and 75 + 100.

Make worksheets (or put on an overhead transparency) with simple equations: 20 = 20% x 100, 40 = 20% x 200, 6 = 10% x 60, 75 = 50% x 150, etc.

Write six questions like: 20 is what percent of 40? 5% of 200 is how much? 27 is 30% of what number? Put each word or term on a separate index card and group the cards for each sentence.

Bring in some items to "sell" at a store, such as pieces of clothing, appliances and/or plan to use some of the students' goods, such as sneakers, bookbags, etc. Have a copy of the text adaptation on the blackboard, a handout, an overhead transparency, or butcher paper.

Warm-Up First review question words, like: how much? how many? what?

Discuss grades--how a teacher finds a numerical grade on a test, for instance. If a test is worth 100 points and a student gets 74, what is that student's percentage/ grade? In order to get an A, a student must get a grade between which percents?

Also discuss sales tax. Ask the students if they pay exactly the price they see on an item in the store or if they pay more. Why? Is there a sales tax on all things? (For example, food is taxed in Virginia, but it isn't in New York.) How do you find the sales tax?

Reading — Have the students read section 1 of the adaptation. Ask some simple questions like: Is 20% the same as 20 + 100? Is 200% more than one or less than one? What percent is 85 divided by 100?

Make two teams (three groups of students in each). Play concentration with the percent cards. Require the students to read their chosen cards aloud. They must read them correctly in order to keep a match.

Have the students read section 2. Hand out the worksheets to the groups and ask them to write the equations as sentences (e.g., the first would be: twenty is twenty percent of one hundred).

Hand out the cards with words or terms on them, one set per group. Each member takes a card or two depending on the numbers in the groups. In turn, the groups stand and organize themselves into a sentence/equation formation, displaying their cards in front of them. (This is called a moveable dictation, if the teacher reads the correct sentence/equation aloud--This could be done with a lower level ability group of students.) Groups correct one another. Pay attention to the position of the question words in the sentences, perhaps they can be moved around.

Vocabulary — Introduce cost, selling price and markup through a simulation. Use the items the teacher brought to class and the students' personal goods. Set up two stores--one that is more expensive than the other. Give examples of different selling prices and markups at these stores. See if the students can explain sale prices that are advertised as 10% discounts.

Reading — Read section 3. Ask the groups to try to set up an equation for one of the examples. Choose one group member randomly to present their group's equation. Compare the work as a class.

Extension — Give the groups some equations like $\$4.00 + \mathbf{m} = \$5.00$, $\$17.00 + \$3.00 = \mathbf{s}$, etc. Ask them to write questions for them, not solve them.

Also ask them to go to a store and ask what the cost, markup and selling price of one item are. They should share the information with the class the next time. Or for further enrichment, specify the item to be sought at a number of different stores and graphically display the results the following day.

APPENDIX C

FURTHER READING

The following articles and books provide additional information about integrating language and content instruction:

Cantoni-Harvey, G. (1987). *Content-area language instruction: Approaches and srategies.* Reading, MA: Addison-Wesley.

Crandall, J.A., Dale, T., Rhodes, N., & Spanos, G. (in press). *Resource materials for English language skills for algebra.* Englewood Cliffs, NJ: Prentice Hall Regents

Crandall, J.A., Spanos, G., Christian, D., Simich-Dudgeon, C., & Willetts, K. (1988). *Combining language and content instruction for language minority sudents.* Silver Spring, MD: National Clearinghouse for Bilingual Education.

Crandall, J.A. (Ed.). (1987). *ESL through content-area instruction.* Englewood Cliffs, NJ: Prentice Hall Regents.

Cuevas, G. (1984). Mathematics learning in English as a second language. *Journal for Research in Mathematics Education, 15,* 134-144.

Curtain, H., & Pesola, C. (1988). *Languages and children: Making the match.* Reading, MA: Addison-Wesley

Evans, R. (1986). *Learning English through subject areas: The topic approach to ESL.* Victoria, Australia: Ministry of Education, Curriculum Branch (Schools Division).

Fein, D., & Baldwin, R. (1986). Content-based curriculum design in advanced levels of an intensive ESL program. *English for Foreign Students in English Speaking Countries Interest Section Newsletter 4 (1), pp. 1-2.*

Mohan, B. (1986). *Language and content.* Reading, MA: Addison-Wesley.

Penfield, J. (1987). ESL: The regular classroom teacher's perspective. *TESOL Quarterly, 21(1),* 21-39.

Restaino-Baumann, L. (1986). *Teaching critical thinking in the content areas.* Paper presented at Bilingual/ESL Staff Development Conference for Bilingual/ESL Teachers & School Building Supervisors, Grades 5-8. New York City Board of Education/Office of Bilingual Education.

Snow, M.A., & Brinton, D.M. (1988). *The adjunct model of language instruction: Integrating language and content at the university (CLEAR Technical Report #8).* Los Angeles: UCLA, Center for Language Education and Research.

Spanos, G., & Crandall, J.A. (in progress). *Language and problem solving in secondary science classes.* Washington, DC: Center for Applied Linguistics.

Spanos, G., Rhodes, N., Dale, T., & Crandall, J.A. (1988). Linguistic features of mathematical problem-solving: Insights and applications. In R. Cocking & J. Mestre (Eds.), *Linguistic and cultural influences on learning mathematics* (pp. 221-240). Hillsdale, NJ: Lawrence Erlbaum Associates.

Willetts, K. (Ed.). (1986). *Integrating language and content instruction.* Los Angeles: UCLA, Center for Language Education and Research.

Willetts, K., & Crandall, J. A. (1986). Content-based language instruction. *ERIC/CLL News Bulletin,* 9 (2). Washington, DC: Center for Applied Linguistics.

APPENDIX D

GLOSSARY

The following abbreviations and terms are frequently used in ESL literature. Brief definitions are provided to explain how these terms are employed in this manual:

Abbreviations/Acronyms:

BICS - Basic Interpersonal Communicative Skills, refers to a construct developed by Cummins that describes a bilingual's basic communicative fluency, or ability to conduct social interactions, in settings that are not cognitively demanding, yet provide contextualized cues.

CALP - Cognitive/Academic Language Proficiency, refers to a construct developed by Cummins that describes a bilingual's cognitive competence for using the second language in an academic setting that does not provide contextual cues.

EAP - English for Academic Purposes, refers to ESL classes that prepare students for the classroom discourse and academic demands that will be placed on them in higher education courses. These EAP courses are frequently found at the university level, though some are offered at the high school level as well.

EFL - English as a Foreign Language, refers to classes offered to non-native speakers of English in countries or settings where English is a foreign language.

ESL - English as a Second Language, refers to classes offered to non-native speakers of English in countries where English is the official language or where English is the medium of instruction in the schools.

ESP - English for Specific Purposes, refers to ESL classes geared for a unique objective, such as Business English or Scientific English, offered to more advanced ESL students.

LEP - Limited English Proficient, refers to a student who lacks proficiency in English, but has some ability to use English.

NEP - Non-English Proficient, refers to a student who has no English ability.

Other Terms:

Language minority student - refers to a non-native speaker of the target language, in this case, English.

Language majority student - refers to a native speaker of the target language, in this case, English.

Content-based language instruction - refers to language classes that use a content-based syllabus to supply the subject matter focus of the lessons; instruction in the language features predominates, but the academic content serves to provide a focus for discussion and for models of the real use of the language (also referred to as content-enriched language instruction).

Language-sensitive content instruction - refers to content classes (e.g., science, social studies, math) where the teachers, aware of the difficulties language minority students face, accommodate these students through adapted materials and teaching strategies. (This term is similar to Language, or English, across the curriculum, which is used internationally, where all the content teachers are also considered teachers of reading and writing in the mother tongue.)

Mainstream class - refers to the "regular" class that native speakers would attend as part of their elementary and secondary education.

Bilingual education - refers to instruction offered in two languages, usually the students' native language and their second language, with the aim that the students will be able to perform academically in that second language. There are three common types:

transitional programs - Content is initially taught in the native language while special instruction is given in the second language so students may be mainstreamed.
maintenance programs - The objective is to develop and maintain proficiency in the native language as well as proficiency in the second language.
two-way programs - Instruction is provided in two languages to both language minority and language majority students in the same classroom so that both groups become competently bilingual. Content instruction begins in the minority language with a period of instruction in the majority language, but eventually half of the subject matter is presented in one language and half in the other.

Sheltered English - refers to instruction in English that is provided exclusively to language minority students for both content subject areas and ESL (also referred to as structured immersion).

Adjunct model - refers to a paired instructional model whereby a content course and a language course have a coordinated syllabus so that the students can prepare for the academic demands of the content course in the language class. This model is often used in post-secondary levels. The content and presentation may be similar to those found in ESP and EAP classes.

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